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Tests of a Wind Machine as an Aid to Burning Slash

HARRY SCHIMKE

Abstract: Tests of a wind machine as an aid to burning slash were conducted on the Stanislaus National Forest in the fall of 1962. The results indicated that the machine accelerated the burning process and enabled burning on otherwise impossible days. But the time and manpower used in handling the machine and its cost made it an impractical substitute for conventional slash disposal methods.

Burning is one of the most economical methods of slash disposal, but climatic conditions in California make this procedure either unsafe or unsatisfactory much of the time. Conditions are often either too hazardous for burning or too wet to get a clean burn.

Theoretically, a wind machine could produce an air stream that would raise the rate of combustion, reduce burning time and expense, and increase fire intensity to permit burning during wet conditions. Use of such a wind machine might enable workers to achieve a maximum amount of disposal during the few good days for burning and permit fires under otherwise prohibitive conditions.

To evaluate these possibilities, three tests were conducted on the Stanislaus National Forest, Tuolumne County, California, in the fall of 1962. They were a followup of a favorable demonstration[1] by Controlled Airstreams, Inc., of a wind machine for slash pile burnings on the Wasatch National Forest in Utah. The machine used in the three tests was a tripod-mounted, portable, 18-inch fan type, driven by a 2-1/2-hp. Clinton engine (fig. 1). Weather conditions were different in each test, ranging from clear to overcast (table 1).

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[1]Personal communication from H. M. Huckeby, chief, Division of Engineering, Region 4, U.S. Forest Service, to Charles Howard, Arcadia Equipment Development Center, May 24, 1961.

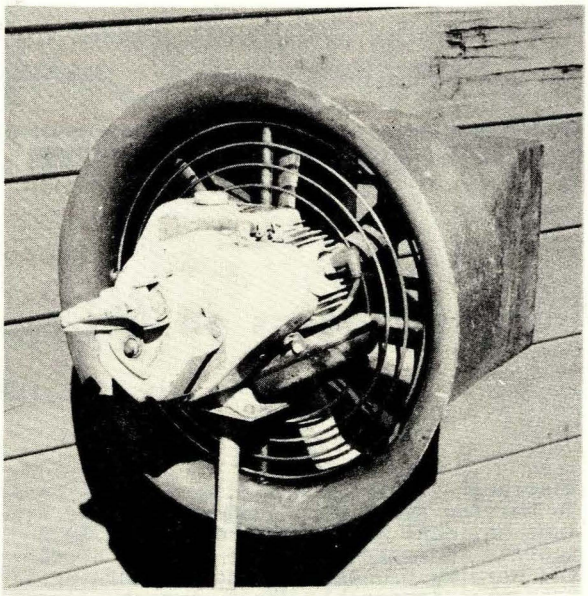

Figure 1.--Wind machine tested as an aid to burning slash released a 40 m.p.h. air stream. It was a tripod-mounted, portable, fan-type.

Table 1. Weather conditions during tests of wind machine for burning slash on the Stanislaus National Forest

Date of test	Temp.	Rel. hum.	Wind Dir.	Wind Vel.	Fuel moisture	Precip. to date	Sky condition
	°F.	*Percent*		*M.p.h.*	*Percent*	*Inches*	
October 23	58	46	SW	8	10.0	3.26	Clear
November 27	48	81	0	0	25.0 +	4.69	Over-cast
November 28	45	80	0	0	24.5	4.69	Partial over-cast

THE TESTS

October 23, 1962. --The first test was conducted on charred material on the Flora burn in the Stanislaus National Forest, 3 miles south of Long Barn at 5,000 feet elevation. The Flora burn occurred in 1960, and covered 2,000 acres. The material consisted of burned-over dry logs, trees, and roots that ranged in size from 3 to 50 inches in diameter. It was bulldozed into two piles, each 75 feet long, 25 feet wide, and 8 feet high.

A diesel-oil flame thrower ignited the two piles. After the fire had burned for 8 minutes, we directed the wind machine into one pile. The unit was 20 feet from the test pile and developed an air stream of 40 m.p.h. at the edge of the pile nearest the machine. A half hour after ignition, this entire pile was on fire, while the control pile had burned only halfway through. After 55 minutes of burning, all but the largest pieces in the test pile were consumed, while the control pile had only reached full blaze. The apparent time gained by using the machine was about 30 minutes. The test was ended at this point because the larger pieces would continue to burn for hours and the two piles were about the same in composition.

November 27, 1962. -- The second test was on two piles of black oak and ponderosa pine limbs and thinnings on Sugar Loaf Ridge, about 11 airline miles southwest of the Flora burn at an elevation of 4,000 feet. Thinning was done in late summer. Most of the material was green, under 4 inches in diameter, and still had many leaves and needles attached. The limbs and thinnings were hand-piled into two circular stacks, 6 feet in diameter and 5 feet high.

We had some difficulty in igniting the piles with fusees. After ignition, the fire would rise through the pile but not spread laterally. Six minutes after ignition, we set the wind machine 18 feet from the pile and released a 40 m.p.h. air stream. The fire swept rapidly through and to the back side of the pile at wind stream level, and consumed the entire back half in 15 minutes. The front half was left unburned because the fire would not burn into the wind. The wind machine was then moved to the opposite side of the test pile and the air stream re-applied. The revived fire consumed the remainder of the pile.

The fire in the control pile also burned a hole through the slash from point of ignition, and then stopped burning. We had to use the diesel-flame thrower to get this pile burning again, but this step took less time than the manipulation and moving of the wind machine.

November 28, 1962. --The third test was conducted on two piles of green black oak and ponderosa pine slash, up to 4 inches in diameter. The material was hand-piled into two stacks, each 15 feet in diameter and 5 feet high. These piles were also ignited with fusees, and 2 minutes later we had the air stream directed into them from a distance of 18 feet. The fire moved rapidly through the pile at wind stream level and, as in the second test, consumed only that fuel in the air stream. Once this fuel was consumed, the fire diminished and would not spread into adjacent fuels until the machine was maneuvered into a new position. The fire in the control pile consumed only the fuel immediately above the point of ignition; surrounding fuels were too wet to burn.

CONCLUSIONS

Although the use of the wind machine accelerated the rate of burning in all three tests and, in the last two, permitted burning under otherwise difficult or impossible conditions, the benefits do not justify the expense. Its major drawback is that for effective operation an operator must be in constant attendance during the entire burning time of each pile. Moving this machine is not difficult because one man can carry it. But on larger piles he would have to move it many times.

On an area similar to that in which the tests were conducted, an operator could probably burn 20 piles a day after he had developed a technique for handling the machine. This area had about 20 piles per acre so that the cost per acre would amount to $32.60.

Other methods of slash disposal are cheaper. For example, the cost of burning the same area by diesel oil flame thrower, at 2 minutes per pile and 2 minutes between piles, was about one-sixth the cost of burning with a wind machine.

The significant difference is in the labor costs for the amount of ground covered. We concluded, therefore, that the use of a wind machine was not a practical substitute for conventional slash disposal methods.

Comparative operating costs are:

	Wind machine	Back-pack flame thrower
Cost of equipment per day[1]	$ 1.00	$ 0.20
Fuel[2]	2.00	7.50
Maintenance and repair	1.00	.50
Operator (8 hrs.@$3/hr.)	24.00	24.00
Mileage (40@11.5¢/mi.)	4.60	4.60
Total	$32.60	$36.80
Number of piles burned	20	120
Acres burned	1	6
Cost per acre	$32.60	$6.13

[1] $200 for wind machine, $40 for flame-thrower; daily depreciation based on 20 working days per year, 10-year life of equipment.

[2] 30 gallons of gasoline at 25¢ per gallon, and oil for wind machine; one-fourth gallon diesel gasoline mix per brush pile (15-foot diameter, 5-foot high) for flame thrower.

HARRY SCHIMKE is a forestry research technician assigned to studies of conflagration control techniques with headquarters at Sonora, California.

U. S. DEPARTMENT OF AGRICULTURE
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PACIFIC SOUTHWEST FOREST AND RANGE EXPERIMENT STATION
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